

Claims

- [1] 1. A method of producing a bio-diesel oil by transesterifying oil/fat with alcohol in a presence of alkyl ester.
- [2] 2. The method as set forth in claim 1, wherein the alkyl ester is added to a mixture of the oil/fat and alcohol by refluxing alkyl ester as a product to the mixture.
- [3] 3. The method as set forth in claim 1, wherein the alkyl ester is added to the oil/fat and alcohol in an amount of 1 to 30 % based on a weight of the oil/fat.
- [4] 4. The method as set forth in claim 1, wherein the oil/fat is selected from the group consisting of vegetable oil/fat, animal oil/fat, waste frying oil, regenerated oil/fat, and a mixture thereof.
- [5] 5. The method as set forth in claim 1, wherein the alcohol is selected from the group consisting of C1 to C10 alcohols, and a mixture thereof.
- [6] 6. The method as set forth in claim 1, wherein the oil/fat reacts with the alcohol in a molar ratio of 1:3 to 1:12.
- [7] 7. The method as set forth in claim 1, wherein the oil/fat reacts with the alcohol in a presence of a basic catalyst or an acidic catalyst.
- [8] 8. The method as set forth in claim 7, wherein the basic catalyst or the acidic catalyst is a homogeneous catalyst, and is added to the oil/fat and alcohol in an amount of 0.3 to 2.0 % based on a weight of the oil/fat.
- [9] 9. The method as set forth in claim 7, wherein the basic catalyst or the acidic catalyst is a heterogeneous catalyst, and is added to the oil/fat and alcohol in an amount of 5 to 80 % based on a volume of a reactor.
- [10] 10. The method as set forth in claim 1, wherein the oil/fat reacts with the alcohol in a batch reactor, a plug flow reactor, or a continuous stirred tank reactor, and when a plurality of reactors are used to react the oil/fat with the alcohol, the reactors are arranged in series, in parallel, or in combination of series and parallel.
- [11] 11. A method of producing a bio-diesel oil, comprising:
 - (a) pre-esterifying a free fatty acid, contained in oil/fat, with alcohol in a presence of an acidic catalyst; and
 - (b) transesterifying the pre-esterified oil/fat and alcohol in a presence of alkyl ester.
- [12] 12. The method as set forth in claim 11, wherein the step (a) further comprises

adding alkyl ester as a product to the reactants.

- [13] 13. The method as set forth in claim 11 or 12, wherein the alkyl ester of the step (a) or/and the step (b) is added to the reactants by refluxing the alkyl ester as the reaction product to the reactants.
- [14] 14. The method as set forth in claim 11 or 12, wherein the alkyl ester of the step (a) or/and the step (b) is added to the reactants in an amount of 1 to 30 % based on a weight of the oil/fat.
- [15] 15. The method as set forth in claim 11, wherein the oil/fat of the step (a) is selected from the group consisting of vegetable oil/fat, animal oil/fat, waste frying oil, and regenerated oil/fat, containing the free fatty acid.
- [16] 16. The method as set forth in claim 11, wherein the alcohol of the step (a) and the step (b) is selected from the group consisting of C1 to C10 alcohols, and a mixture thereof.
- [17] 17. The method as set forth in claim 11, wherein the oil/fat containing the free fatty acid reacts with the alcohol in a molar ratio of 1:0.3 to 1:3 in the step (a), and the oil/fat reacts with the alcohol in a molar ratio of 1:3 to 1:12 in the step (b).
- [18] 18. The method as set forth in claim 11, wherein the step (b) is conducted in a presence of a basic catalyst or the acidic catalyst.
- [19] 19. The method as set forth in claim 18, wherein the basic catalyst or acidic catalyst is a homogeneous catalyst, and is added to reactants in an amount of 0.3 to 2.0 % based on a weight of oil/fat.
- [20] 20. The method as set forth in claim 18, wherein the basic catalyst or acidic catalyst is a heterogeneous catalyst, and is added to reactants in an amount of 5 to 80 % based on a volume of a reactor.
- [21] 21. The method as set forth in claim 11, wherein the step (a) and the step (b) are conducted in a batch reactor, a plug flow reactor, or a continuous stirred tank reactor, and when a plurality of reactors are used to conduct the step (a) and the step (b), the reactors are arranged in series, in parallel, or in combination of series and parallel.